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ABSTRACT

A device for refilling partly empty liquid-helium cryostats is described. Use of this device enables the researcher to accomplish the refilling with minimum loss of residual liquid helium and minimum disturbance of sample temperature.

It is frequently necessary for the experimenter doing low-temperature work to refill a partly empty liquid-helium Dewar during the course of a series of measurements. It is well known that performing this operation with a warm transfer tube results in the loss of some or all of the liquid helium remaining in the Dewar. Several liters of residual liquid helium are easily evaporated by the flow of boiloff gas while the transfer tube is cooling. Furthermore, after these several liters of liquid have been evaporated, the temperature in the specimen chamber may rise to 20° or 30° K before liquid helium again begins to collect in the liquid chamber.

Techniques and devices for avoiding these problems have been described by Scott[1] and, more recently, by White[2].

Another such device is described here; it is especially useful if the transfer tube must be left in the cryostat between transfers and allowed to warm up.

The device is shown in Fig. 1. A transfer is begun when the liquid-helium level has dropped below hole H. The initial flow of boiloff gas, resulting from cooling of the transfer tube, is vented through tube A (thin-wall stainless steel), disk D having been removed. Hole H prevents the residual liquid from being siphoned into tube A. When the transfer tube has cooled, liquid helium collects in tube A and subsequently overflows standpipe B (also thin-wall stainless steel) into the liquid-helium chamber of the Dewar. The O-ring fitting permits easy removal of the transfer tube from the cryostat.

Transfers have been accomplished in this manner into a 3-l Dewar with a loss of less than 0.2 l of the 0.6 l of residual liquid helium. The accompanying temperature change (observed with a germanium thermometer immersed in the residual liquid) was 0.02° K at worst and not observable at best.

Although the tube system (tubes A and B) is shown in Fig. 1 as a part of the experimental cryostat, there appears to be no reason why it could not be made a permanent part of the transfer tube. The dimensions of the device must be adjusted to the requirements of the individual cryostat, and hence no dimensions are indicated in Fig. 1. The author's experience indicates that 1/2 and 3/16 in. are probably the lower limits of outside diameter for tubes A and B, respectively.

Acknowledgment

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REFERENCES

1. Scott, Russell B., Cryogenic Engineering. Van Nostrand, Co., Princeton, 1959.

2. White, Guy K., Experimental Techniques in Low-Temperature Physics. Oxford University Press, London, 1959.

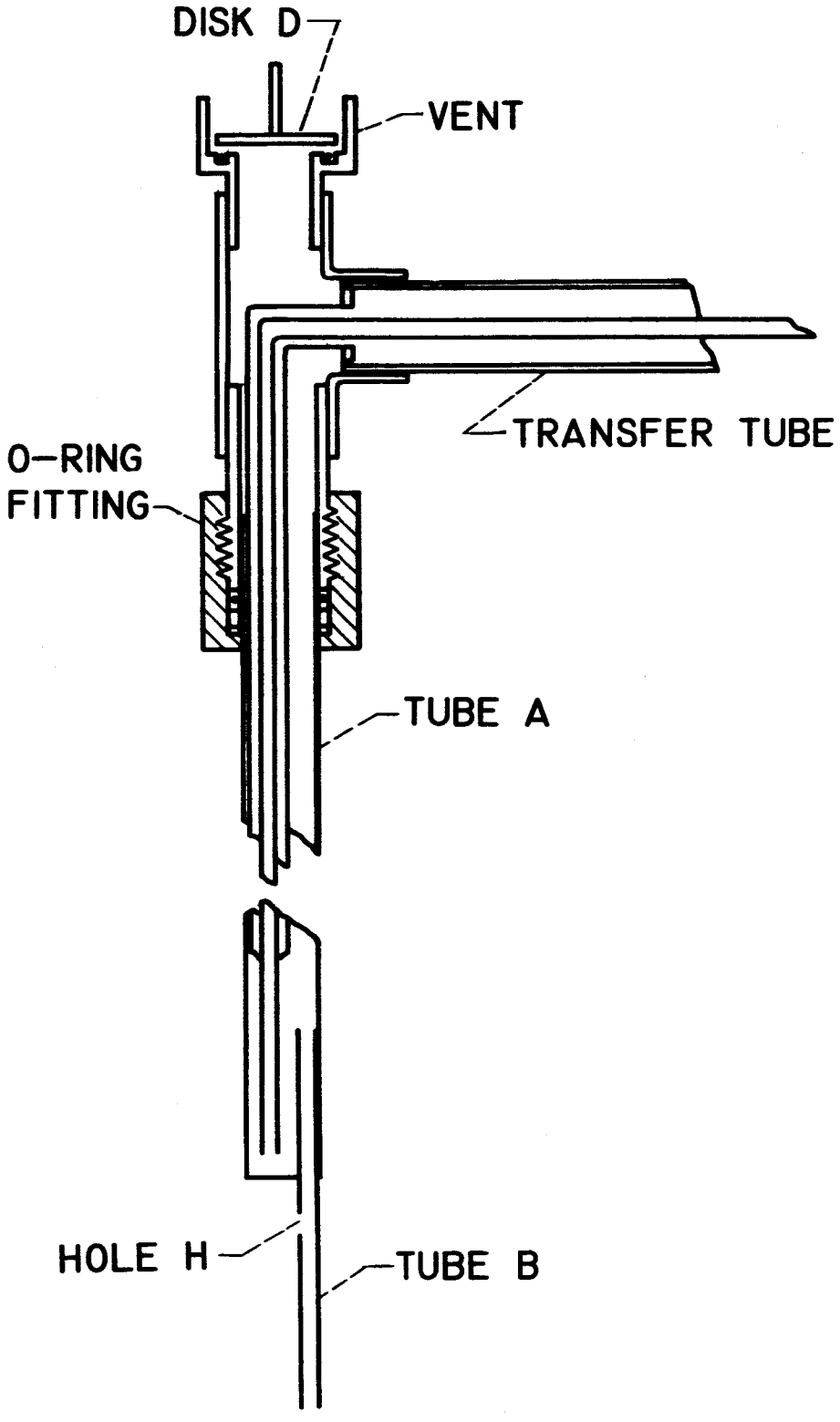

Fig. 1. - Liquid-helium transfer device.